

REMARKS

This Amendment is responsive to the final Office Action dated October 28, 2004. In this Amendment, Applicant has canceled claims 57 and 58, and amended claims 1, 3-13, 15-20, 22-31, 33-38, 40-50, 52-56, and 59-68. Claims 1-56 and 59-68 are pending.

Allowable Subject Matter

In the Office Action, the Examiner indicated that claims 10, 18, 29, 36, 47, 55 and 68 would be allowable if rewritten in independent form.

Amendments

In this Amendment, Applicant has amended all of the independent claims to more clearly specify the application of one or more constraints to destination device-dependent coordinates produced by a multi-dimensional color transformation. In addition, the amendments specify that the constraints are applied to prevent removal of selected colorants specified by the source device-dependent coordinates, per amended claims 1-9, 11, 12, 20-28, 30, 38-46, 48, and 49, to prevent the introduction of selected colorants not specified by the source device-dependent coordinates, per amended claims 13-17, 19, 31-35, 37, 50-54 and 56, or to prevent substitution for colorants specified by the source device-dependent coordinates, per amended claims 59-68. These amendments should make the distinctions between the claimed invention and the method described by the Stokes reference even more clear, as discussed in detail below.

Claim Rejection Under 35 U.S.C. § 103

The Examiner rejected claims 1-9, 11-17, 19-28, 30-35, 37-46, 48-54, 56, and 59-67 under 35 U.S.C. § 103(a) as being unpatentable over Stokes (USPN 5,611,030). Applicant respectfully traverses the rejection, to the extent it may be considered applicable to the claims as amended. Stokes fails to disclose or suggest the inventions defined by Applicant's pending claims, and provide no teaching that would have suggested the desirability of modification to arrive at the claimed invention.

For example, Stokes provides no teaching that would have suggested constraining destination device-dependent coordinates produced by a multi-dimensional color transformation

to prevent removal of selected colorants specified by source device-dependent coordinates, as required by amended claims 1-9, 11, 12, 20-28, 30, 38-46, 48, and 49.

In addition, Stokes fails to disclose or suggest constraining destination device-dependent coordinates produced by a multi-dimensional color transformation to prevent introduction of selected colorants not specified by source device-dependent coordinates, as set forth in amended claims 13-17, 19, 31-35, 37, 50-54 and 56.

Stokes also lacks any suggestion of a method for multi-dimensional color transformation comprising applying a multi-dimensional color transformation for transformation of source device-dependent coordinates to destination device-dependent coordinates, and constraining the destination device-dependent coordinates to a range of matching destination device-dependent coordinates searched by the multi-dimensional color transformation as a function of the source device-dependent coordinates to prevent substitution for colorants specified by the source device-dependent coordinates, as required by claims 59-68.

According to Applicant's claims, constraints are applied to yield destination device-dependent coordinates that preserve a desired relationship between selected colorants specified by source device-dependent coordinates and colorants actually used by the destination device. In this manner, the claimed invention is useful in selectively preserving colorant integrity between the source and destination devices at the device-dependent level. In particular, the claimed invention can prevent undesired substitution for selected colorants specified by source device coordinates.

In support of the rejection, the Examiner stated that Stokes provides a method of mapping source device colors to destination device colors in a system having a source imaging device and a destination imaging device with "non-coincident gamuts." The Examiner further stated that, in the Stokes method, "[i]f the color name associated with the out-of gamut color and the color name associated with the first in-gamut color are different, the out-of gamut color is remapped to a different in-gamut color within the color gamut of the destination device." Hence, the Examiner recognized that Stokes is directed to the problem of gamut mapping between a destination imaging device and a source imaging device.

The claimed invention is not directed to gamut mapping, but rather to techniques for constraining the output of a multi-dimensional transformation to preserve selected colorants

specified by source device-dependent coordinates. Application of one or more constraints, as defined by Applicants' claims, avoids undesirable colorant substitutions that can result from multi-dimensional transformation. A multi-dimensional transformation typically involves transformation from a source device-dependent coordinate system (e.g., CMYK) to a device-independent color space (e.g., XYZ, $L^*a^*b^*$, etc.). Then, the device-independent color space is used to produce destination device-dependent coordinates (e.g., CMYK).

Due to under color removal (UCR), gray component replacement (GCR), other color replacement techniques, or metamerism, the destination device-dependent coordinates produced by multi-dimensional transformation may not bear a direct relationship to the source device-dependent coordinates. The destination device-dependent coordinates may provide an acceptable colorimetric match to the source device-dependent coordinates. For example, device-independent $L^*a^*b^*$ values for the destination device-dependent coordinates may be approximately equal to $L^*a^*b^*$ values for the source device-dependent values. However, the actual combination of colorants specified by the destination device-dependent coordinates may be different from the colorants specified by the original source device-dependent coordinates.

In some applications, it is desirable to preserve a direct relationship between selected source device-dependent coordinates and destination device-dependent coordinates in terms of the actual colorants used by the destination device. In view of this objective, the claimed invention applies constraints to the device-dependent coordinates produced by the multi-dimensional transformation. This approach limits the possibility of generating different sets of device-dependent coordinates that map to particular device-independent coordinates. In particular, the claimed invention better preserves the relationship between the source device-dependent coordinates and the destination device-dependent coordinates. Even though a typical multi-dimensional transformation may produce multiple sets of destination device-dependent coordinates that provide an acceptable colorimetric match, only those destination device-dependent coordinates that satisfy the applicable colorant constraints are actually selected in accordance with the claimed invention.

In her analysis, the Examiner pointed out that, in the gamut mapping technique described by Stokes, "the source device coordinates are the source device independent color space coordinates of $L^*a^*b^*$ and the destination device coordinates are the destination device

independent color space coordinates $L^*a^*b^*$ (emphasis added).” Accordingly, the Examiner appears to appreciate these differences between the claimed invention and the Stokes reference, but has broadly interpreted the terms “source device coordinates” and “destination device coordinates” in Applicant’s claims to encompass device-independent coordinates.

In this Amendment, Applicants have amended the pending claims to more clearly specify that the constraints are applied to destination device-dependent coordinates produced by the multi-dimensional color transformation. The constraints are applied to prevent removal of selected colorants specified by source device-dependent coordinates, per amended claims 1-9, 11, 12, 20-28, 30, 38-46, 48, and 49, prevent introduction of selected colorants not specified by source device-dependent coordinates, per amended claims 13-17, 19, 31-35, 37, 50-54 and 56, or as a function of the source device-dependent coordinates to prevent substitution for colorants specified by the source device-dependent coordinates, per claims 59-68.

Thus, in contrast to Stokes, the claimed invention requires the application of constraints to destination device-dependent coordinates produced by the multi-dimensional transformation. In the remarks accompanying the response filed June 23, 2004, all of which are incorporated herein by reference, Applicant stated that Stokes describes a set of gamut mapping rules for selecting a color within the gamut of a destination device when the source color is not within the destination device gamut. Stokes makes no mention of the application of a constraint to destination device-dependent coordinates produced by a multi-dimensional transformation, as defined in Applicants’ claims. Indeed, Stokes has no regard for preservation of colorants specified by source device-dependent coordinates.

The Examiner acknowledged that “Stokes does not directly teach the prevention of the removal of selected color image data specified by source device coordinates or the prevention of the introduction of specified color image data not specified by source device coordinates.” However, the Examiner asserted that the color name mapping technique applied by Stokes can be interpreted as the prevention of removal of a specified color. In particular, the Examiner pointed to the process by which Stokes manipulates the device-independent color values so that an out-of-gamut color resides within the same color name boundary as in-gamut color.

Applicant respectfully disagrees with the Examiner’s characterization of Stokes, especially in light of the amendments to the claims. Even if an out-of-gamut color and an in-

gamut color share a broad name category, the out-of-gamut color and in-gamut color still do not match, either colorimetrically or in terms of the actual colorants used to reproduce the color. Indeed, the entire point of Stokes is how to handle a mismatch. Moreover, the name mapping described by Stokes does nothing to constrain the actual colorants used by the destination device to prevent color removal, introduction or substitution, as defined by Applicant's claims. Instead, as acknowledged by the Examiner, the Stokes method operates in a device-independent color space.

In FIGS. 2 and 4, for example, Stokes depicts the application of the name mapping technique to colors defined within the XYZ device-independent color space. Stokes states that the name mapping technique can be applied in an XYZ or $L^*a^*b^*$ color space, both of which are device-independent color spaces. Stokes, Col. 7, 38-42. As explained above, however, there may be many different combinations that satisfy the name constraint applied by Stokes at the device-independent level. Yet, at the device-dependent level, the destination device may realize some of the XYZ or $L^*a^*b^*$ values using colorant combinations that differ substantially from the colorant combinations specified by the original source device-dependent coordinates.

In view of the amendments and differences discussed above, Applicants respectfully request reconsideration by the Examiner. Stokes fails to disclose or suggest the inventions set forth in Applicants' claims, and provides no teaching that would have suggested modification to arrive at such inventions. Therefore, Stokes does not support a prima facie case of unpatentability with respect to Applicants' claims, and the rejection under section 103 should be withdrawn.

In focusing on the requirements of the independent claims, Applicants neither admit nor acquiesce in the propriety of the rejections applied against the dependent claims. For purposes of brevity and focus, and in view of the fundamental shortcomings of the Stokes reference discussed above, Applicants have at this time withheld further comments concerning the features set forth in the dependent claims. Applicants reserve the right to further address other features of the independent or dependent claims in any future communications.

CONCLUSION

All claims in this application are in condition for allowance. Applicant respectfully requests reconsideration and prompt allowance of all pending claims. Please charge any additional fees or credit any overpayment to deposit account number 50-1778. The Examiner is invited to telephone the below-signed attorney to discuss this application.

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1-24-05

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